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U.S. INTERNET **DECEMBER 19, 2014**

Weekend Media Blast: And Now For Something Completely Different...

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By Carlos Kirjner

This is the last Weekend Media Blast of 2014. When we write the Blast, which is always published on Friday, our aspiration is to bring insight to investors in a less formal (and boring) and ideally more interesting style. We feel the bar is higher on December 19, as many are starting to focus on the holiday season.

This week we considered many alternatives for the main theme of the blast. For example, we could have written about the massive and not-yet-fully reflected in consensus F/X impact on Google's and Amazon's 4Q14 and 2015 results (nowadays holidays in Europe, Japan, or Brazil are really, really cheap), but F/X just did not seem like the type of topic that offers many possibilities for an interesting discussion.

We thought about discussing the feeling of *déjà vu* when we are asked whether apps pose a threat to Google search, a view we think it is very difficult to justify given the very high penetration of smart phones and apps[1].

Finally, we could also do what pretty much every other sell-side analyst is doing now, which is to publish something about 2015 "positioning."

Picture of the Week #1

Source: Wikimedia

Instead, we opted for something completely different[2], a topic we are sure thousands of investors worldwide are waiting eagerly and anxiously to hear about: *distributed cryptographic protocols* and their potential impact on the evolution of the Internet and Internet businesses. There is nothing more exciting on a late December Friday than a detailed piece on cryptography!

Nothing worthwhile is easy. If you did not think "bitcoin" when you read "distributed cryptographic protocols," then we can almost guarantee you will learn something interesting if you get to the end of today's Blast.[3] Good luck.

For starters, suppose we wanted to create a secure way to transact over the Internet[4], for example, for Alice to send Bob something that would have the characteristics of "digital money." This transfer would have to involve a digital message, zeroes and ones, that in some way indicates that Alice transferred value to Bob. Because bits are so easy to copy, there are many problems that have to be solved, and the most important ones are related to identity and duplication and forgery issues. Are Alice and Bob who they say they are? If a message is "signed by Alice" (we will discuss below what we mean by signing a digital message), how do we make sure this is really her signature? What prevents Alice, Bob, or someone else to replicate a message sent by Alice transferring value to Bob many, many times?

We could have Alice write a message such as "I am giving Bob a shekel" (*Picture of the Week #1*) and cryptographically sign the message. Cryptographic signatures are ways to guarantee that it was Alice who created the message[5]. This is progress but it does not solve the forgery and duplication problem. Specifically, Alice could send the same message to Bob one million times and Bob or someone else, maybe Charlie, can under the right circumstances copy the message and resend it another billion times.

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[1] These effects, to the extent they create headwinds are already and have been in the numbers for quite some time.

[2] Some readers will recognize our title. It is the title of Monty Python's first ever movie, a precursor to some of their fundamental contributions to the Western canon, all of which are highly recommended, including The Life of Brian, The Holy Grail and The Philosopher's Football Match https://www.youtube.com/watch?v=ur5fGSBsfq8

[3] Whether or not it is useful, that is hard to say, but interesting and useful seems to be an unrealistic high bar to set for ourselves this late in the year (or anytime).

[4] We read a lot about the subject to come up with a clear (even if not the most concise) explanation about distributed cryptography and found the article by Michael Nielsen http://www.michaelnielsen.org/ddi/how-the-bitcoin-protocol-actually-works/ extremely helpful. The original paper, found here https://bitcoin.org/bitcoin.pdf is also quite helpful. They have both heavily influenced our views and our presentation in today's blast.

In the physical world forgery is avoided or minimized by making money difficult to copy, e.g., with watermarks and special paper, and by ensuring notes are unique by adding serial numbers that can issued only by a central authority, a central bank (directly or indirectly through the mint.

The same central bank concept can be used in the digital realm. When Bob receives the message from Alice, it could come with a specific serial number for the shekel Alice is transferring to Bob. Bob could then check in with the central authority to validate that Alice indeed owns that specific shekel and complete the transaction in this central authority's centralized ledger. Digital signatures can ensure that it is nearly impossible for anyone to impersonate the central bank. In this scenario, the central bank keeps a centralized ledger.

Can we make this work without this central authority? Can we resolve the forgery and duplication issues with another approach that does not require a centralized authority and ledger?

If the word bitcoin makes you think of something like "a wacko speculative scheme created and supported by nerds to turn money digital, used primarily by drug dealer's and others engaged in illegal transactions, and which probably will get squished or kept as a niche as regulators step in," you may not be just wrong on how Bitcoin, the currency, will ultimately evolve, but you are actually missing the point about Bitcoin, the distributed cryptographic protocol[6]. Its method to create and update a distributed, eventually consistent ledger is in our view Bitcoin's most fundamental, potentially disruptive innovation, which, as we will discuss below, may in the fullness of time be used in many different ways, several of which highly relevant for (Internet) investors.

To us, the narrow view that the impact of Bitcoin and its associated distributed cryptographic protocol(s) are just about digital money is akin to saying, in the late 60s, that the Internet is a US-government funded technology to connect national labs, universities and research centers. It may have been technically correct at that point in time, but it was surely short sighted.

How does bitcoin create and manage this distributed ledger? The fundamental new idea is the *blockchain*. The way bitcoin gets rid of the central authority is to have every user keep a record of every transaction and hence a copy of the current ledger[7].

If Alice now wants to give a specific Shekel to Bob, let us assume a shekel labelled 123, then upon receipt of a message signed by Alice saying she is giving Bob that specific shekel, Bob could look at is copy of the ledger, verifies that Alice indeed owns shekel 123, update his copy of the ledger, and broadcast the transaction to everyone so that all can update their copies of the ledger. This procedure would prevent Alice from sending Bob shekel 123 multiple times.

Unfortunately, in general the propagation of information between users in a network is neither instantaneous nor equally time consuming across any two user pairs, that is, it may take more time for Bob to get a message from Alice than for Charlie to get the same message. As a result, one can envisage a scenario wherein Alice pays Bob with Shekel 123, Bob accepts the transaction and broadcasts it, but before the information that Bob took Alice's shekel 123 reaches Charlie, Alice sends the same shekel 123 to pay Charlie, who proceeds to authenticate and accept that message from Alice. In other words, Alice would give both Bob and Charlie the same shekel123.

To deal with this difficulty, before accepting shekel123 sent by Alice (in a message she created and signed), Bob broadcasts the transaction to the network so that other members check their own copies of the blokchain to verify that Alice indeed owns shekel123. When enough of them agree that this is the case, then everyone in the network updates their own copies of the blockchain with the transaction.

We are making progress, but as described above the protocol has another issue: a user could try to kidnap the network and control the decisions about which transactions are validated. If it is fast and easy for someone to check whether a certain transaction (e.g., Alice wants to give Bob shekel 123) is valid, then Alice could find a way to create many different pseudo-users Alice1, Alice2, …, all the way to

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[5] Many of these cryptographic signature methods (e.g., RSA) use a public-private key construct. The first step is to associate with each user a unique pair of public and private keys. For example, user Alice will get a pair of keys if she can prove to someone that she is the user Alice on Facebook, Twitter and GitHub. Once a unique pair of keys, one private and one public, is associated with a unique, authenticated user, they can be used by that user to sign messages and by other users to recognize the signature. The general idea is that "the private key locks, while the public unlocks, and the public key can only unlock what was locked by the private key." For example, Alice can append a signature S to the message M using a private key, which we will call PrK_A (Private Key for Alice) that only she knows. Alice's signature to message M is created by applying a mathematical transformation whose inputs are the message itself and the private key. The message and the signature are sent to a recipient, let us say, Bob. Alice also has a public key, which Bob and everyone else know. The cryptographic signature methods will provide a verification process that has the following characteristic: given a message M, a signature S associated to M, and Alice's public key PuK_A, the verification process will return "TRUE" if M, S and PuK_A are used as inputs only if S was created from the message M and Alice's private key PrK_A. In other words Alice's private key encodes M, and only her public key can decode the result.

[6] There are in fact three related but very different "Bitcoins:" the currency, the network of users of the software, and the distributed cryptographic protocol.

[7] Of course, this is done in a "smart and efficient" way and it is not exactly right that every user has a copy of the ledger at every moment in time. There may be temporary inconsistencies, but the protocol is designed to resolve them eventually.

Alice10,000,000, and "take over" the network, as follows: when someone, e.g., Bob, broadcasts a transaction to the other users in the network to validate, for example Alice sending Bob shekel123, the many, many nodes controlled by Alice all answer "yes, Alice owns shekel 123" convincing Bob that this is the case and de facto validating the transaction. Immediately after this, the 10 billion Alices do exactly the same with Charlie and David, thus allowing Alice to use shekel123 multiple times.

The way to solve this problem is to make it computationally costly to check whether a transaction is consistent with the existing blockchain. This way each of the 10 billion Alices hypothesized above would have to correspond to material computational power, and hence creating 10 billion of them would be very expensive.

To make authenticating a transaction costly, Bitcoin requires any user checking whether a transaction is consistent with the current blockchain solve a puzzle requiring considerable computational resources. This puzzle is called a "proof-of-work."

This proof-of-work puzzle is based on a cryptographic transformation called a hash function[8], which every user has access to as it is built into the Bitcoin protocol and standards. Generally speaking, a hash function takes a set of characters of arbitrary length as input and uses math to output another set of characters of a given length. The key characteristic of a hash function is that given the output it takes a lot of computational effort to find an input that generates that output. Loosely speaking one can say that hash functions are different to invert (i.e., it is difficult to figure out the input that gives you a certain output)

In the case of Bitcoin the input to the hash function associated with the proof-of-work is made up of the message M describing a transaction (Alice paid Bob shekel 123) and an additional set of characters. Let us imagine that this character set is called C. The puzzle a user trying to verify that a transaction described by the message M is consistent with the current blockchain needs to solve to have proof-of-work is this: find C so that if M and C are put jointly through the hash function, then the output has some very specific characteristics defined by the protocol, e.g., in the first 40 digits, every digit is zero.

Because it is hard to invert a hash function, it is hard to find a set of characters C solving the proof of work puzzle. By "hard" we mean that it takes considerable computational effort.

We are now ready for a very rough, but accurate enough (for sell side work) description of how the Bitcoin distributed ledger works.

Once Bob receives a message from Alice saying that she is paying Bob shekel123, Bob checks Alice signature appended to the message using Alice's public key. He then checks that according to his copy of the blockchain Alice owns shekel123 and broadcasts the transaction to the other Bitcoin users, "the network."

If user David is the first one to solve the proof-of-work puzzle associated with the message associated with the transaction[9], he checks that the transaction is consistent with his copy of the blockchain and then broadcasts the message together with the solution to the puzzle, the proof-of-work. Other participants in the network verify David's solution to the proof-of-work puzzle associated with the message, which they can do since the hash function is known to all users on the network. Following our example, they would take the ("Alice is paying Bob shekel123"), David's proof of work and put both together through the hash function and check that the first 40 digits of the output are zero. If that is indeed the case, they would then update their copies of the block chain to include the new transaction represented by the message.

Because obtaining the proof-of-work requires computational resources, users undertaking this task must be receive an incentive to deploy their computational power for that purpose. In the bitcoin protocol, this validation process is called *mining*. For each transaction validated, the successful miner receives a bitcoin reward. A miner’s chance of being the first to obtain the proof-of-work is roughly equal to the proportion of the total computing power that he or she controls. As a result, if a lot of computing power is being brought to bear by different users mining, a dishonest miner is likely to have only a relatively small chance to corrupt the validation process, unless they expend a huge amount of computing resources.

This need to pay miners to deploy their computational power to solve the proof-of-work puzzle, validate transactions and allow the updating of the blockchain illustrates why Bitcoin and the blockchain first application probably had to be monetary transfer. It enabled the creation of efficient mechanisms to incent miners. But this is by no means the only application supported by the protocol.

The Bitcoin protocol supports a large number of features and functionality that can be used for many different types of transactions. Some of these are often referred to as "smart contracts." They include, for example, micropayments, dispute mediation (where the beneficiary of a transaction is decided by the votes of multiple parties, e.g., 2-out-of-3), automated mediation, where a computer decides who a transaction benefits and when the transaction occurs based. For example, a transaction can be conditional on the value of an exchange rate or a sports result (a bet), set to occur at a specific time, or dependent on some event occurring, such as someone turning 18 and/or someone dying, as in the case of an inheritance. All of these and many more can be supported by Bitcoin's blockchain protocol. In concept at least, many different transactions types, marketplaces and asset classes supported by the current banking system, as well as some that do not exist or can only be implemented at high cost and complexity today can be efficiently implemented on a distributed fashion using Bitcoin and its blockchain.

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[8] We are happy to go through the technical details of what a hash function is and how exactly the puzzle is created, just send us an email

[9] We will discuss further below why David would bother to deploy its computational resources to validate a transaction between Alice and Bob, but the answer is simple in concept: he gets paid a transaction fee.

There are more applications, some unrelated to payments. Bitcoin's distributed protocol can be used as the basis to provide identity services, that is, authenticating and sharing information about users with third-parties such as apps and their developers.

Today there are two major providers of identity services emerging on the Web. Facebook, which uses its social graph encompassing 1.3 billion users and Google's identity services, based on Google Plus, which have an only slightly smaller reach. Twitter is a distant third. An increasing number of apps and sites offer users the alternative to logon using their Facebook or Google credentials. Pinterest, Uber, Lyft, Tinder, Hinge and many others in fact *require* or are designed to *strongly encourage* its new users to logon with either Facebook, Google or (less often) their Twitter credentials.

While app developers benefit from gaining information about their users from Facebook and Google (including, importantly, from Facebook, their social networks which can be crucial for apps with "social" elements[10]), Facebook and Google benefit by having increased visibility into users' activities, leading, for example, to improved ad targeting to these users across the Web.

Today, in part because of their scale, in part because of their technology capabilities but also in part because of their ability to authenticate and track the behavior of users at an individual level, Google and Facebook are positioned to be the winners in online advertising, eclipsing everyone else.

It is highly uncertain whether or not the existence of a technical solution that enables truly distributed identity services poses a threat to this trajectory and the future dominance by Google and Facebook. The realization of the threat may be triggered by service innovation by some start up built on the Bitcoin's blockchain technology (e.g., Onename), by regulation on privacy by the FTC in the US or the by the European Commission in Europe, or by a spontaneous shifting in consumer attitudes towards their data and privacy online (which is think is highly unlikely but not impossible). It is also possible that this threat we identify will never materialize, but investors should not ignore it.

Net, net, Bitcoin is really not just about an alternative payment method for nerds and drug dealers. It may take 3, 5 or 10 years or maybe an eternity for the technologies associated with it to have a material effect. However, ignoring the possibility is clearly short sighted. Long term investors doing so do it at their own peril.

We wish all Happy Holidays and a Prosperous and Happy New Year.

Quote of the Week

"To the extent I can save money by not paying somebody to be carried because their content is generally available elsewhere, I think that is an opportunity."

– Tom Rutledge, CEO Charter Communications, on potential new OTT network services

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[10] The key reason why it matters that Google has missed the social boat again, and again, and again even though it has nearly caught up with Facebook as the provider of authentication services

Disclosure Appendix

Ticker Table

						EPS			P/E			
Ticker	Rating	CUR	18 Dec 2014 Closing Price	Target Price	TTM Rel. Perf.	2013A	2014E	2015E	2013A	2014E	2015E	Yield
GOOG	O	USD	511.10	650.00	NA	19.10	20.27	25.68	26.8	25.2	19.9	NA
AMZN	O	USD	297.73	450.00	-38.7%	0.58	-0.25	1.65	NM	NM	NM	NA
EBAY	O	USD	57.53	60.00	-5.6%	2.18	-0.05	2.70	26.4	NM	21.3	NA
FB	M	USD	78.40	72.00	27.2%	0.59	1.06	0.83	NM	73.9	94.7	NA
NFLX	U	USD	334.42	260.00	-25.0%	1.84	3.46	4.40	NM	96.7	76.0	NA
TWTR	M	USD	36.73	50.00	-47.7%	-3.41	-1.03	-1.14	NM	NM	NM	NA
YHOO	M	USD	50.91	60.00	13.3%	1.27	7.45	0.60	40.1	6.8	84.9	NA
SPX			2061.23			108.41	116.89	128.02	19.0	17.6	16.1	1.9%

O – Outperform, M – Market-Perform, U – Underperform, N – Not Rated

Valuation Methodology

U.S. Internet

We value companies in our coverage using a combination of DCF, and forward Enterprise Value to EBITDA and Price to EPS multiples.

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U.S. Telecommunications

Our price targets are generally based on a discounted cash flow (DCF) valuation. We calibrate our DCF-based TEV by calculating the implied TEV/NTM EBITDA and TEV/NTM (EBITDA-capex) multiples to check their reasonableness across the companies in our coverage and against historicals for each individual company. We believe these market multiples are most relevant for the telco sector, whose companies have high depreciation expenses due to their dependence on network assets that require high levels of capex to maintain and upgrade.

We value each of our coverage companies using the weighted average of a discounted cash flow analysis and a relative market multiple valuation. For our relative multiple valuation, we apply our Q5-Q8 EPS earnings estimate to a relative PFE multiple selected based on past history, projected growth rates, and the company's ability to generate returns in excess of the cost of capital, all relative to that of the S&P 500.

Our DCF valuations are conducted on a sum-of-the-parts basis for each major operating segment of our respective coverage companies, with comparable company valuation benchmarks used when appropriate and available. Our DCF model is based on annual cash flow forecasts over an explicit period, combined with a continuing value component intended to capture the firm’s value into perpetuity. Our explicit period assumptions are based on annual projections for NOPLAT, depreciation, capital expenditures, and working capital. The fair market value of common equity determined by each of these methods is divided by the current diluted share count and multiplied by one plus the cost of equity minus the current dividend yield (1 + Ke - d) to calculate a target share price in 12 months time.¬

We then weight the market multiple component of our valuation 50% and the DCF 50% in order to establish a weighted average target price.

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Risks

U.S. Internet

Sector risks:

- Global economic conditions: Consumer and advertising spend are the main drivers of revenue for all companies in our coverage, and deterioration of economic conditions could have a material negative impact on revenues and earnings of all companies in our coverage.
- Cyber-security: All companies in our coverage depend on the global Internet. Their data (including user-data), infrastructure, and services could be compromised either by malicious attackers or by an "act of God" that compromises major portions of their Internet infrastructure. This could have a major negative impact on revenues and earnings of all companies in our coverage.
- Network neutrality: Companies in our coverage pay telecommunications service providers for terminating their traffic in accordance to local regulation and business practices, either directly or through third-parties (e.g., CDNs). They do not pay to ensure that their traffic is delivered to the end user with a higher or lower priority than other traffic from the Internet. If fixed or mobile telecommunications service providers were to charge Internet companies for the delivery of bits beyond the usual traffic termination charges, the revenues, earnings and stock prices of companies in our coverage could be negatively affected.
- Privacy: Privacy-related regulation or a major leak of consumer information leading to lower Internet usage could have negative impact on the future revenues, earnings and stock prices of all companies in our coverage.
- Disruptive innovation or global competition: Companies in our coverage derive the majority of their revenues from Internet advertising (GOOG, YHOO), e-commerce and e-commerce related services (AMZN, EBAY), and the delivery of content over the Internet (NFLX). Because of relatively low barriers to entry, they face the risk of increased competition from a new entrant or from a established business in an adjacent space (e.g., Google, Apple or Netflix selling books online); successful entry or even its announcement could have a negative impact on future revenues, earnings and/or stock prices.

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U.S. Telecommunications

Price war between major players takes value out of entire sector, particularly damaging given high fixed cost economics

At-scale entry, e.g., by player from adjacent sector, disrupting industry economics

Regulatory interventions redistributing value

Difficulty in precisely forecasting potential pension/OPEB cash impacts, given uncertainty on actuarial assumptions, regulatory changes, pension accounting nuances, and limited reporting requirements

Consumer and advertising spend are significant drivers of revenue for most of the companies in our coverage. The deterioration of economic conditions could have a material negative impact on revenues and earnings of the companies in our coverage and on the stocks' achieving our target prices. The health and stability of the video distribution ecosystem is vitally important with respect to the delivery of our companies' television content. New and innovative platforms that offer video distribution could potentially disrupt the ecosystem, thereby jeopardizing the primary distribution partners (cable, satellite) of each of our companies. Additionally, piracy of content could serve to undermine the profitability of a product that typically is produced with the expectation of multiple distribution methods and time horizons for which that product can be monetized.

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  Outperform: Stock will outpace the market index by more than 15 pp in the year ahead.

  Market-Perform: Stock will perform in line with the market index to within +/-15 pp in the year ahead.

  Underperform: Stock will trail the performance of the market index by more than 15 pp in the year ahead.

  Not Rated: The stock Rating, Target Price and estimates (if any) have been suspended temporarily.
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12-Month Rating History as of 12/18/2014

Ticker	Rating Changes	
AMZN	O (IC) 11/04/11	
EBAY	O (RC) 01/25/13	
FB	M (RC) 02/12/13	
GOOG	O (IC) 11/04/11	
NFLX	U (RC) 06/25/13	
TWTR	M (IC) 12/05/13	
YHOO	M (RC) 09/22/14	O (RC) 10/29/13

Rating Guide: O - Outperform, M - Market-Perform, U - Underperform, N - Not Rated
Rating Actions: IC - Initiated Coverage, DC - Dropped Coverage, RC - Rating Change

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